NAVIGANT

PROJECT TO CONDUCT ANALYSIS TO UPDATE ENERGY EFFICIENCY POTENTIAL, GOALS AND TARGETS FOR 2013 AND BEYOND

Work Plan

Prepared for:
California Public Utilities Commission
KEMA

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1 Introduction

Navigant Consulting, Inc. and our partners the Heschong Mahone Group and Waypoint Building Group's approach to conducting an analysis that updates the CPUC energy efficiency potential, goals and targets for 2013 and beyond follows two tracks. The team will conduct Tracks 1 and 2 in parallel and in close coordination to provide guidance for the utilities' next energy efficiency portfolios. This will include clear guidance on sector level potential based on the historic and projected contribution of high impact measures as well as quantify the potential for emerging technologies, markets, legislative initiatives and changing baseline and code environments. We will develop the output of our work in a way that supports integration of the study results into the state's energy efficiency planning process, including the IOUs' energy efficiency goals, the California Energy Commission's (CPUC) Integrated Energy Policy Report, and the CPUC's Long Term Procurement Planning Proceeding.

Track 1 of the study will provide a thorough analysis of the economic potential energy saving within the state's IOU territories using Navigant's EERAM (Energy Efficiency Resource Assessment Model) tool. Navigant has used this Excel based model within California and in other parts of North America for years. It is flexible, transparent and based on inputs that are similar to the ASSET model used in the 2008 study. This allows us to incorporate many of the ASSET model inputs and outputs and calibrate with past studies to ensure continuity of approach while expanding on the modeling capabilities needed to accomplish new objectives, such as incorporating the strategic plan.

Track 2 will focus on identifying key market drivers that can impact the Total Market Gross, and yield a set of goals and targets that encompass the breadth of activity occurring within the state. Several features of our approach include;

- Conduct a thorough vetting of all assumption related to attribution of savings for each of the market drivers and related sector impacts to ensure savings are not "double counted".
- Develop a bottom-up estimate of the Technical Total Statewide Potential for each driver utilizing existing assumptions and estimated savings or developing new estimates of strategy savings, as required.
- Conduct a collaborative screening process to categorize each driver as "most likely" "may be likely" or "not likely" to having savings impacts over the planning period.
- Evaluate the market achievable savings potential from each of the KMDs identified as a result of Task 4 under "high", "medium", and "low" scenarios. Compare scenarios to goals when possible.
- Identify the core technologies (HIMs) that are responsible for the energy savings from the KMDs. Calculate the energy savings specifically from the HIMs.
- Develop goals and targets for individual and Total Statewide Market Savings expected over the study period to be captured by the KMDs.
- Provide CPUC and statewide planners a comprehensive set of tools to facilitate planning by easily identifying key opportunities for savings as well be the ability to run "what-if" scenarios.

1.1 Key Project Issues

1.1.1 Foundational issues

As the team plans for its Track 1 and 2 analyses there are a number of foundational issues that have influenced the design of this study, and for which additional guidance will be provided during the course of the project. This guidance may alter the final work product as described in this work plan.

1. ***Incentive Scenarios***

   Levels of incentives have played a central role in the development of market potential. In the 2008 potential study the market potential was a direct function of incentives, expressed as a percentage of incremental measure cost. The problem with this approach is that different measures will require different levels of incentives to encourage a significant fraction of the market to adopt. And the levels of incentives will probably need to change as measures move up the market adoption curve. For example, a widget that is an emerging technology just entering the market, may require an incentive that exceeds its incremental measure cost (talking about just the limited incremental measure costs of the hardware compared to what it replaces, not all of the other soft costs that go into installing the widget). It may make sense to pay a higher incentive in order to push the technology into the market and bring down the cost over the long term by increasing awareness and availability. The general expectation is that the need to pay such high incentives would go down as the measure becomes more prevalent in the market.

   To address this issue, Navigant proposes to build the goals and targets model to accommodate variable incentive levels for measures, as a function of their adoption status in the market, rather than applying a single filter to all measures.

2. ***Avoided Cost and the Loading Order***

   Two fundamental policy decisions by the CPUC that affect the work of this project directly are the assumed avoided costs of energy and the policy to place energy efficiency first in the loading order for new resources. These two policies could be considered to work at cross purposes. The avoided costs of generation are based on the cost to build a combined cycle gas turbine generator with an allowance for the cost of carbon. The loading order places renewable generation second after energy efficiency, which if reinforced by the Renewable Portfolio Standard. Given the status of renewables, some have pointed out that the marginal cost of generation should be the cost of the renewable resource rather than the fossil fuel resource. If energy efficiency is to be first in the loading order, perhaps "all cost effective energy efficiency" should include measures that provide energy at costs all the way up to the cost of renewables.

   To address this Navigant proposes to build the models to accommodate various avoided cost scenarios, including variations of both fossil generation and renewable generation avoided costs, rather than doing all the analysis based on just the cost of fossil generation. The application of renewable generation or fossil fuels is to be determined by the Commission.

3. ***Alternatives to the TRC***

   Energy efficiency stakeholders have commented that the CPUC's definition of the total resource cost test (TRC) contains assumptions that drive the energy efficiency potential in California. These include the discount rate, which is currently set to (lower rates reflect a broader societal perspective),

the life of the measure (longer lives allow for more aggressive measures), the avoided cost (higher costs allow for more aggressive measures), the use of incremental measure costs that ignore some of the actual costs (e.g. innovation risk or limited availability time delays), the use of net instead of gross benefits (limits market penetration assumptions), etc. Some have even proposed that the use of the TRC be abandoned altogether for planning purposes, as has been done in the Northwest.

As part of this issue, commenter's have suggested that the program administrator cost test (PAC) is really all that should matter from the perspective of utility goals to acquire savings. The primary difference between the TRC and the PAC is the incremental measure cost that the customer pays. The suggestion is that, if the customer adopts the measure at the utility's incentive level, the incremental measure cost must not be a barrier.

To address this Navigant proposes to build the models that allow users to apply diiferent cost tests used to establish economic potential and to establish goals.

4. ***Treatment of Market Transformation benefits***

The TRC currently does not account for market transformation benefits, which is particularly problematic for the CPUC's policy objectives to promote market transformation since these measures and activities tend to have a lower TRC in early years of program implementation. In earlier potential studies, any measure that had a TRC lower than 0.85 was excluded from the economic potential and presumably from the goals as well. Subsequent policy direction asked the utilities to deliver a portfolio that had a TRC of 1.25. Both of these decisions, if applied to this study, are likely to reduce or eliminate the emphasis on market transformation. Measures that are early in their life cycle may not be cost effective, but there may still be good reasons to pursue them (build market or capacity, raise market awareness, help bring down costs, etc.).

One way that these issues have been addressed is to offset the net cost of these programs with the net saving of programs with a high TRC, which leads to a relatively low TRC for the entire portfolio, and leads the IOUs to invest heavily in measures with high short term savings and low market transformation potential. Another way to address these issues is to set benefit/cost criteria for programs that vary over time, perhaps with allowance for higher benefit/cost in the early stages of market adoption. The threshold could then be lowered as the measures become more widely accepted in the market.

To address this Navigant proposes to build variable benefit/cost criteria (varying by market adoption status and time) into the Track 2 model. The intended benefit will be to allow program administrators to develop integrated, market sector programs that cover all efforts to transform a given sector.

1.1.2 Key issues identified during coordination and outreach activities

In addition to the foundational issues, several issues have been raised during the outreach activities that have taken place prior to the release of this plan, including several requests by the SCE, Sempra, and PG&E that the Goals/Potential Study include:

- Information on future economic/market potential available to IOU programs including not only the current HIMs but also key emerging technologies and behavioral programs.

- Improved "lifecycle analysis" of EE measures to better understand which delivery method and level of incentives is appropriate at different stages over the potential/goals time horizon (2013-2022).
- An analysis of the economic/market potential of the primary long-lasting EE strategies highlighted in the 2008 California Long-Term EE Strategic Plan.
- An analysis of how economic/market potential changes as key assumptions in the TRC calculation such as the discount rate and incorporation of non-energy benefits change.
- Transparency into the potential modeling process ideally through a publically available model that can be re-simulated in the years between potential study updates to incorporate new information.

2 Potential Study Work Plan

2.1 *Model Overview*

Navigant will develop the Potential study using its Energy Efficiency Resource Assessment Model (EERAM). EERAM is an Excel based tool that is capable of detailed, bottom-up potential studies or higher level aggregated approaches to estimating potential. Previous assessments of California Statewide energy efficiency potential were developed through Itron's ASSET Potentials Model. The ASSET model provided detailed estimates by utility service area, climate zone, sector, building type, and measure over a twenty year forecast horizon of Technical, Economic, and Market Potential. These model results were used to help define the investor owned utility annual goals.

The Economic Potential Study will outline the process for identifying the technical and economic potential for energy efficiency for the years 2013 through 2024. While EERAM is designed to be less detailed than the ASSET model, it is intended to produce consistent outputs with the previous study, making this Potential and Goals Study an update to the 2008 Goals and Potential Study. The study will be updated in two ways. First, EERAM will use results of previous ASSET model runs, incorporating parameters that have been updated through program evaluations, DEER or other study, many of which are addressed under Track 2. Second, EERAM input datasets will represent aggregations of similar detailed datasets used by ASSET but the aggregation process must be performed so as to produce similar results. ASSET models a large portfolio of measures at a detailed building stock level for each climate zone. EERAM will identify the high impact measures as its primary portfolio of measures with analyses performed at the sector and utility level rather than the detailed building and climate zone level.

The Potential Study will incorporate the best available information, drawing from 2008 ASSET model, DEER, and the Standardized Program Tracking (SPT) database, which is a collection of the entire utility program ex ante and ex post estimates of energy impacts, measure life, and net to gross. The advantage of this SPT is that all of the utility achievements are categorized into standard measure groupings across the utilities to ease comparisons and to standardize reporting. The SPT covers program years 2006 through 2009 with program year 2010 currently being added. The accounting of these programmatic achievements will also be used to help update the technology density information for the building stocks.

The 2008 update to DEER will also be used as a source for energy and demand impacts, useful life, net to gross, and measure cost information. DEER is about to be updated again and the Navigant team expects to use the members of the DEER update team as reviewers of the energy impact information. It is anticipated that a measure list by sector, that represents both current high impact measures as well as future high impact measures will be developed by utility that includes per unit estimates of energy and demand impacts from the last Itron ASSET model implementation, the SPT database, and 2008 DEER. This measure list with comparison per unit energy and demand impact information will be provided to the DEER update team for their review and comment.

2.1.1 Key Outstanding Potential Model Issues

Interested parties are encouraged to provide input on the following issues:

1. What additional emerging technologies or other sources of potential energy saving should be included as sources of technical potential that have not already been included in the potential study? (see Appendix 4.2 for the current list of technologies being considered)
2. How should behavioral impacts be quantified?
3. Should there be an alternative cost-effectiveness screen (such as the PAC) included in the model?
4. Should the cost-effectiveness screen include an estimate of administrative costs?
5. Should the low income market potential be treated separately by separating the low income population from the remaining housing stock and model their impacts separately[1]?
6. Should there be adjustments made to the total potential to account for the current housing market conditions, (ie. 30% of homeowners that are "underwater"?)
7. How to address re-participation at the end of Measure Life:
    a. Assume savings continue by assuming the original participant installs at least an equivalently efficient technology?
    b. Make this a blanket assumption or a variable assumption?

2.2 *Modeling Tasks*

2.2.1 Obtain Key Data Sets

Measure to be included in the potential study will be categorized as follows;

- DEER HIM Measures
- Non-DEER HIM Measures
- Measures of Interest (MOI) and Emerging Technologies (ET)
- Non-HIM, non-MOI Measures
- Custom Measures

Data necessary to understand the performance characteristics of these measures, and their relationship to the market will be gathered from a number of different sources, and theses source may vary depending on the measure category being considered. The following sections discuss the data to be considered for both general modeling and measure category specific needs.

2.2.1.1 Obtain 2008 ASSET Model Inputs and Create Initial EERAM Input Datasets

One of the basic building blocks of both the ASSET and EERAM models are building stock characteristics that identify the densities of base technologies and efficient replacement technologies by building type. The goal for the EERAM model is to have this information at the utility and sector level. However, the input data for the last ASSET model implementation is at the building type and climate zone level. The key ASSET model data that will be utilized by the EERAM model are:

[1] This issues will be addressed with formally through the proceeding

1. Base and energy efficient technology densities for each of the efficiency technologies considered
2. Energy and demand impacts
3. Efficiency measure costs
4. Efficiency measure life
5. Decision maker estimates of measure awareness and purchase willingness
6. Technology applicability
7. Building stock totals

This ASSET data is disaggregated by building type and climate zone. Under this task, these disaggregated values will be weighted by building stock totals into a sector level dataset to aggregate the datasets at the sector level for each of the utilities. The measure list with its accompanying information on densities, impact, etc. will form the starting point for EERAM input values, but not the final dataset. Other dataset information, such as SPT and DEER 2008, will also be rolled into it for comparative evaluation purposes before the final dataset is created.

Task 2.2.1.1 Deliverables and Schedule: The product from this task will be datasets of utility and sector level representations of the detailed building and climate zone level data included in the ASSET model inputs. This task has already been completed.

2.2.1.2 Integrate data from the Standard Program Tracking Database

Standard Practice Tracking (SPT) database compiles the results of the 06-08 evaluations, which will be used to develop select inputs for high impact measures (HIM) that were evaluated in the 2006 – 2008 ED evaluation projects. The SPT database currently includes detailed utility program accomplishment information for 2006 through 2009 with 2010 expected to be available soon. The amount of data is extensive, but the categorization of the data into the Energy Division (ED) measure group categories allows for combining the data from the many programs into consistent measure groups.

Within this task, the SPT data will be consolidated into the ED measure groups weighting the program savings within each ED category by ex-ante energy saving values. The result of this consolidation will be a dataset by utility and sector that includes the following variables:

1. 2006 - 2009 kWh Ex Ante First Year Gross
2. 2006 - 2009 - kWh Ex Post First Year Gross-Interactive
3. 2006 - 2009 - Therms Ex Ante First Year Gross
4. 2006 - 2009 - Therms Ex Post First Year Gross-Interactive
5. kWh Ex Ante UES - 2006 - 2009
6. kWh Ex Post UES-Interactive - 2006 - 2009
7. Watts/kWh ratio Ex Ante - 2006 - 2009
8. Watts/kWh ratio Ex Ante - Interactive - 2006 - 2009
9. Therms Ex Ante UES - 2006 - 2009

10. Therms Ex Post UES-Interactive - 2006 - 2009
11. Net-to-Gross Ratio (NTGR) Ex Ante - All
12. NTGR Ex Post - kWh
13. NTGR Ex Post - Therms
14. EUL Ex Ante
15. EUL Ex Post

The total energy and demand savings by year will be utilized to calibrate the results from EERAM. The total savings by ED measure group will be used to identify the high impact measure (HIMs) of existing technologies that will be modeled within EERAM. In addition, discussions with various stakeholder groups will be held to identify measures of interests (MOIs) and emerging technologies (ETs) that will be modeled. The UES values by year will be merged with the ASSET model UES values for comparison and interpretation purposes.

Task 2.2.1.2 Deliverables and Schedule: The products from this task will be datasets by ED measure group of the variables identified in the bullet list above. This task will be completed in July.

2.2.1.3 Integrate DEER HIM Measure data

The DEER database is extensive with detailed information on measure impacts and cost at the building type, vintage, and climate zone level. However, many of the measures have aggregate values at the utility level. The utility level measure data for the HIMs identified in Task 2.2.1.2 will be extracted. This data will include measure impact, cost, and measure life information. This data will be merged with the data collected in Tasks 2.2.1.1 to help inform what values should be used as inputs into the EERAM model. The primary source of inputs for these measures will be:

- Measure inputs will be based on 2006 – 2008 HIM evaluation data
- Most recent DEER data will be used to provide additional inputs

The data from Task 2.2.1.3 will be provided to the DEER project team, as well as other interested parties. The evidence provided by these different datasets as well as the insights and experience of the reviewing parties should lead to an agreed upon set of input values for the HIM measures.

Task 2.2.1.3 Deliverables and Schedule: The products from this task will be DEER HIM measure level input values for EERAM by mid August.

2.2.1.4 Integrate Non-DEER HIM Measure data

There are HIMs that are not included in the DEER database being referenced for this project and these data for these HIMs will be gathered for several sources, including but not limited to:

- Results from 2006 – 2008 evaluation data for HIMs measure inputs
- Work papers referenced in D.09-09-047 and D.11-07-030, and reviewed by ED's Data Management & Quality Control (DMQC) contractor will be used to provide additional inputs

The measures parameters developed by the team for non-DEER HIMS will be provided to the DMQC project teams, as well as other interested parties. As with the DEER HIMs, the insights and experience of the reviewing parties should lead to an agreed upon set of input values for the non-DEER HIM measures.

Task 2.2.1.4 Deliverables and Schedule: The products from this task will be non-DEER HIM measure level input values for EERAM by mid August.

2.2.1.5 Integrate Measures of Interest (MOI) and Emerging Technologies(ET) data

The Potential Study will also assess the potential for a class of measures designated here as 'Measures of Interest'. These are measures that are not high impact measures in that they have not historically contributed 1% or more of total portfolio savings, nor are they classified as emerging technologies because they have been available on the broader market and are included in the 2010 – 2012 portfolio of core programs, but have been identified as significant potential sources of future energy savings. Examples of MOIs include;

- LED street lighting
- Advanced evaporative cooling systems

The economic potential for emerging technologies will be considered in this report using the following process;

1. An extensive list of available emerging technologies will be compiled from various sources, including;
    a. The Statewide Emerging Technologies program
    b. The Portfolio of the Future program
2. A set of criteria will be developed and applied to this list to identify those measures that present a reasonable opportunity for reasonable field performance and market acceptance

The report will include an explicit statement about the energy efficiency potential in emerging technologies and will retain the "current emerging technologies" (CETs) classified used in the 2008 report. Appendix 4.2 provides a preliminary list of emerging technologies being considered and the technologies included in the 2008 study.

Task 2.2.1.5 Deliverables and Schedule: The products from this task will be datasets MOI and ET measure level input values for EERAM by late August.

2.2.1.6 Non-HIM, non-MOI Measures

The 2008 Itron study analyzed 66 measures in the existing residential sector, 100 measures in the existing commercial sector, and 161 measures in the existing industrial sector. While this current study will report on these same sectors, research will be focused on measures designated as high impact measures, measures of interest, and emerging technologies. The results will be that some measures studied in 2008 will not fall into any of these categories. These measures, labeled non-HIM, non-MOI measures will be reviewed briefly to identify the following;

- If they are still in the 2010-2012 portfolio and whether or not they are likely to be retained for all or part of the horizon for this study.

- If the measures parameters used in the 2008 study remain reasonable. For example, this will include an assessment of whether measure costs should be adjusted for some index such as the consumer price index or a producer price index.
- Which of these measures may be subject to code or standards revisions?

Task 2.2.1.6 Deliverables and Schedule: The products from this task will be datasets non-HIM, non-MOI measure level input values for EERAM by mid August.

2.2.1.7 Custom Measures

Custom measures present a challenge to potential studies because of the breadth of activities and projects installed under this category. For this study a custom measure representation will be developed by building type for the commercial and industrial sectors. These measure will defined as custom lighting, custom HVAC, or custom other, consistent with the descriptors used in the 2006-2008 EM&V studies. Inputs for these measures will rely heavily on the following data sources;

- The SPTdb for 2006 through 2010
- The most current version of CEUS
- The 2006-2008 EM&V reports

Task 2.2.1.7 Deliverables and Schedule: The products from this task will be datasets custom lighting, custom HVAC, and custom other input values for EERAM by mid August.

2.2.2 Finalize Input Values for EERAM

The data collected and reviewed in Tasks 1-1 through 1-3 provide only part of the data needed to create an EERAM model run. Other important data includes building stock forecasts by sector and utility, electricity and natural gas price forecasts by sector and utility service area, avoided costs, efficiency measure incentive levels, and measure level administrative costs.

It is expected that the building stock forecasts and the electricity and natural gas price forecasts by sector and utility service area will come from the California Energy Commission. Initially, the data will come from the 2009 IPER, however, when the 2011 IPER data becomes available (expected later in the summer), it will replace the 2009 IPER values. The team will also review and utilize data from the CPUC's 2006 – 2008 energy efficiency evaluation reports listed in Appendix A: 2006-2008 EM&V Reports.

Avoided cost values need to be adopted by Commission decision. It is our understanding that the avoided costs for energy efficiency programs are currently under review. However, we will utilize the most recent avoided cost estimates from the 2010-2012 cycles until these are revised.

EERAM currently applies administrative costs to measures as cost/kwh or therm. This method is has shortcomings since administrative costs are generally borne at the program level rather than the measure, therefore Navigant seeks input from stakeholders regarding the treatment of administrative costs.

Task 2.2.2 Deliverables and Schedule: Two primary products will result from this task. The first is the complete dataset of input values for EERAM. The second is a series of discussion issues with resolution

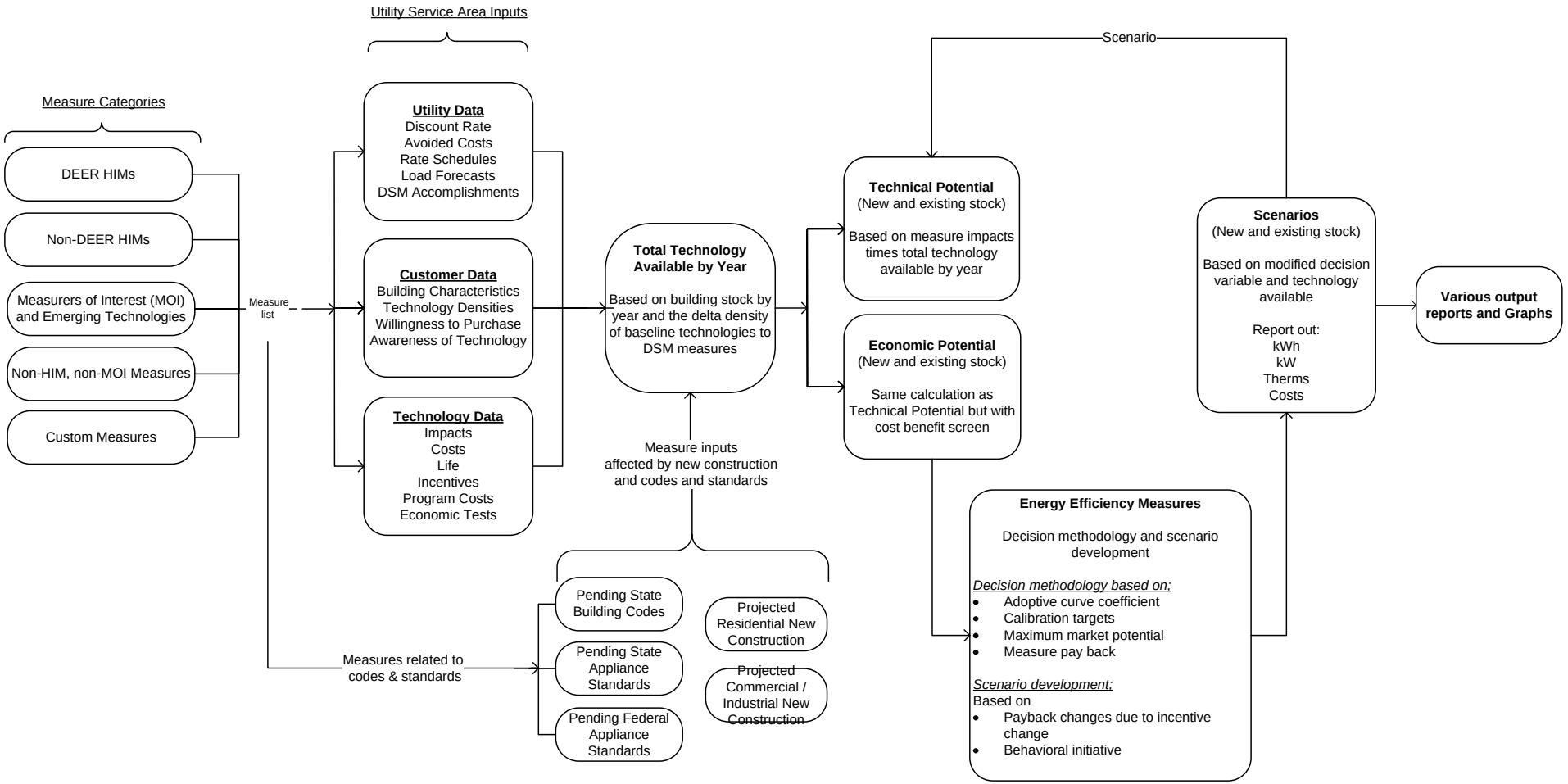
of the issues noted, on the topics listed above and any other issues yet to be identified. It is expected that this task will be completed by the end of July.

2.2.3 Build the EERAM Model

Figure 1 provides a process flow diagram of the EERAM model. The team will assemble the measure lists from the measures categories and utility service area inputs provide the total technology available by year. This will include a process to assess the impacts of new construction and codes and standards. The pending 2013 Title 24 revision will be assessed, as well as planned 2016 and 2019 revisions. Title 20 and pending federal appliance standards codes will be assessed as well. In general these reviews will be conducted at a measure by measure level for all measures impacted by new construction or codes and standards activity.

***Task 2.2.3 Deliverables and Schedule**:* The products from this task will be a functional EERAM model by the end of August.

Figure 1. EERAM Model Schematic



2.2.4 EERAM Runs

Utilizing all of the final EERAM inputs identified in the earlier tasks and resolution of issues identified in Task 1-4, initial EERAM runs will be performed. The starting year will be 2006 and the forecast will run through 2026. The utility data included in the SPT database will be used to help calibrate the model for actual savings as reported in 2006 through 2010. It has been our experience many iterative runs of the model will be needed before finalizing the results for use in Track 2.

Task 2.2.4 Deliverables and Schedule*:* Final EERAM model runs by utility and sector will be the deliverable for this task. It is expected that the final runs will be ongoing through September.

2.2.5 Integration with Track 2

The primary purposes of Track 1 are to develop an estimate of Economic Potential and estimate the savings that could be achieved with utility programs. However, many other modeling considerations beyond these two Track 1 products are included in this project. Most of these will be completed under Track 2, but it is possible that some of the Goals Study tasks will be incorporated into the EERAM tool. The purpose of this task will be to identify what other assessments should be undertaken using EERAM. Some of the other assessment considerations include effects of codes and standards, emerging technologies, and price effects.

Task 2.2.5 Deliverable and Schedule: This will be an ongoing assessment starting in June and will be periodically reported to the ED and stakeholders as directed by ED.

2.3 Reporting

Results will be provided by measure category and market sectors consistent with the sectors defined in the 2008 potential study.

Task 2.3 Deliverable and Schedule: The results of the economic potential model for the IOU services territories will be provided at the end of September, with a full report, including methodological discussion to follow at the end of December. The December report may include a revised EERAM model that encompasses a total market gross output that provides a summary of the potential available in the IOU territories. The methodology to determine TMG will be provided separately.

3 Goals and Targets Study Work Plan

Track 2 Goals and Targets Study will be a strategic analysis and model that identifies the level of energy savings that can be achieved from the combination Key Market Drivers (KMD), including State legislation, Strategic Plan initiatives, IOU programs and other market activities. The Study will first identify the Total Market Gross Goals (TMG) (defined in Section 3.1.1), which includes all Key Market Drivers. The TMG Goals are designed to meet the needs of the IEPR forecast and GHG proceeding, as well as the Portfolio Guidance Proceeding. The study will then recommend IOU-specific targets to provide CPUC guidance on IOU portfolio development and oversight.

As an overview, our approach is to:

- Conduct a thorough vetting of all assumption related to attribution of savings for each of the market drivers and related sector impacts to ensure savings are not "double counted".
- Develop a bottom-up estimate of the energy efficiency savings potential for each driver utilizing existing assumptions and estimated savings or developing new estimates of strategy savings, as required.
- Conduct a collaborative screening process to categorize each driver as "most likely" "may be likely" or "not likely" to having savings impacts over the planning period.
- Evaluate the market achievable savings potential from each of the KMDs identified as a result of "high", "medium", and "low" scenarios. Compare scenarios to goals when possible.
- Identify the core technologies – high impact measures (HIMs), measures of interest (MOIs) or emerging technologies (ETs) – that are responsible for the energy savings from the KMDs. Calculate the energy savings specifically from each of these measure categories.
- Develop goals and targets expected over the study period to be captured by the KMDs.
- Provide CPUC and statewide planners a comprehensive set of tools to facilitate planning by easily identifying key opportunities for savings as well be the ability to run "what-if" scenarios.

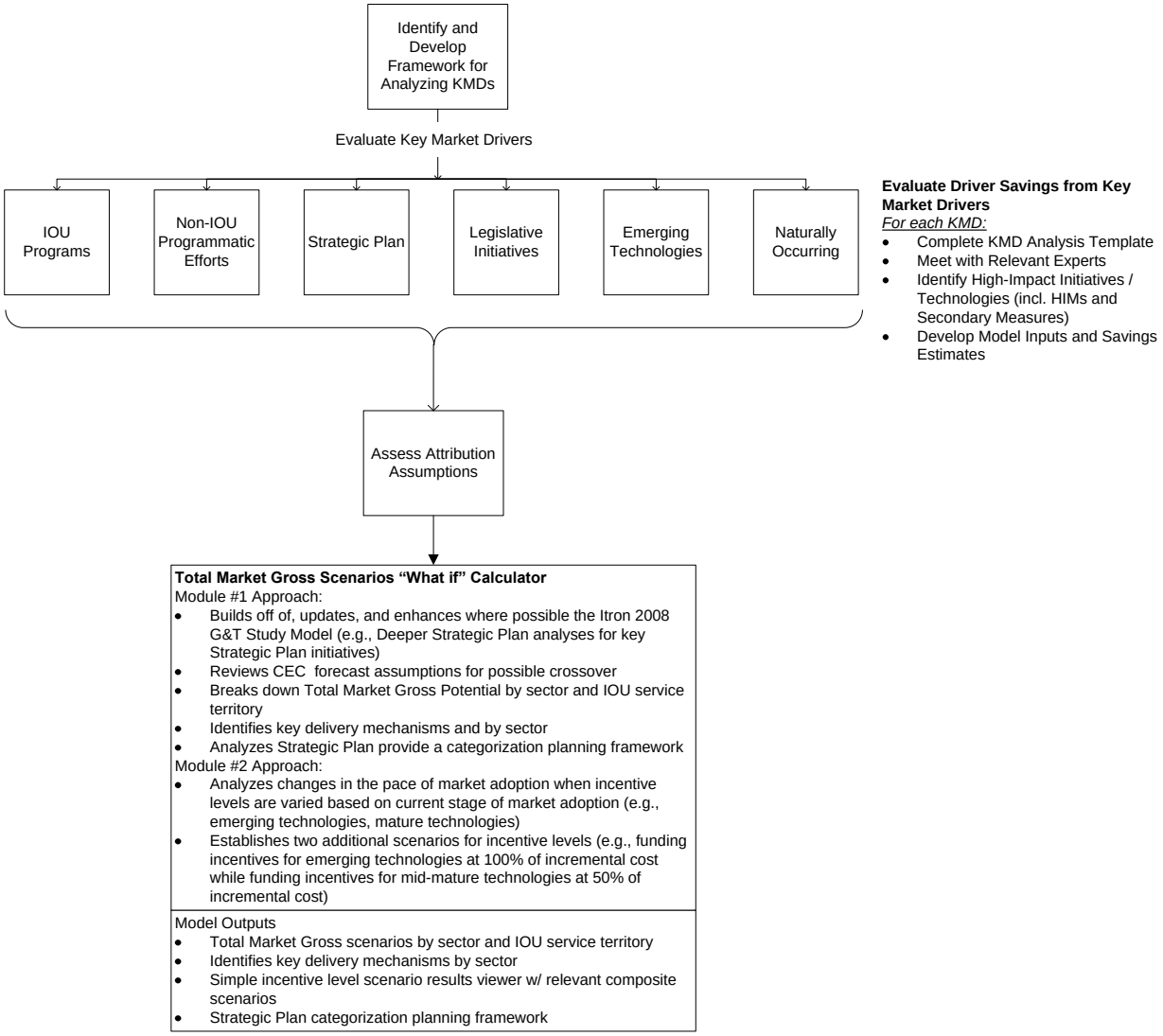
This section describes more specifically the approach that Navigant will take to complete the goals and targets portion of this project. Section **Error! Reference source not found.** provides an overview of the model that Navigant is developing for this effort and Section **Error! Reference source not found.** describes the steps that the project team will take to develop the inputs for the model and to produce the outputs. Section 3.3 provides an overview of the reporting schedule and content for the Track 2 effort.

3.1 Model Overview

The development of the Track 2 model coincides with multiple tasks within Track 2. The model will receive inputs that result from the analysis of all of the KMDs, including strategic plan initiatives and legislative measures as presented in Figure 2. The model will incorporate an accessible graphical user interface to enable straightforward analysis of different scenarios in its role as the Total Market Gross Calculator.

The Track 2 model will align with the EERAM model used in Track 1 where relevant. For key inputs, such as load forecasts or unit energy savings or building stock growth rates, the Track 2 model will use the same assumptions as in the EERAM model. In addition, the Track 2 model will utilize the outputs of the EERAM model, which include technical and economic potential in the IOU service territories. These approaches will ensure consistency across the two modeling platforms and will reduce the amount of time needed to solicit and obtain stakeholder buy-in on key data points.

Figure 2. Goals and Targets Modeling Process



3.1.1 Key Outstanding Goals and Targets Modeling Issues

In presentations to stakeholders, there has been confusion regarding the definitions of key concepts in the Goals. To ensure that there is shared understanding, the Goals Study methodology will be based on definitions adopted by the Commission:

- **Total Market Gross**: (per D.08-07-047) "The total market gross goal would represent the level of cumulative energy efficiency potential (a) available between 2012 and 2020 within the IOU service territory, and (b) able to be achieved through all reasonably measurable delivery channels including improvements in state and federal codes and standards, state legislative mandates, naturally occurring efficiency, and IOU voluntary programs (both resource acquisition and market transformation)."
- **Free Riders:** (per D.08-07-047) are defined as "program participants who take advantage of a utility energy efficiency service or incentive, but would have implemented the program measure or practice even in the absence of the program." (p. 15)
- **Market Transformation**: (per Decision 09-09-047, September 24, 2009): Market transformation is long-lasting, sustainable changes in the structure or functioning of a market achieved by reducing barriers to the adoption of energy efficiency measures to the point where continuation of the same publicly-funded intervention is no longer appropriate in that specific market. Market transformation includes promoting one set of efficient technologies, processes or building design approaches until they are adopted into codes and standards (or otherwise substantially adopted by the market), while also moving forward to bring the next generation of even more efficient technologies, processes or design solutions to the market.

Navigant seeks input from the parties on the following:

1. How should "naturally occurring savings" be defined and calculated?
2. Since Total Market Gross is only defined as savings in IOU territories, should TMG goals include non-IOU potential, or should codes and standards savings associated with non-IOU territories be removed from the TMG?

3.2 Modeling Tasks

This section outlines the key steps that the project team will take to inform the modeling effort and produce the key outputs.

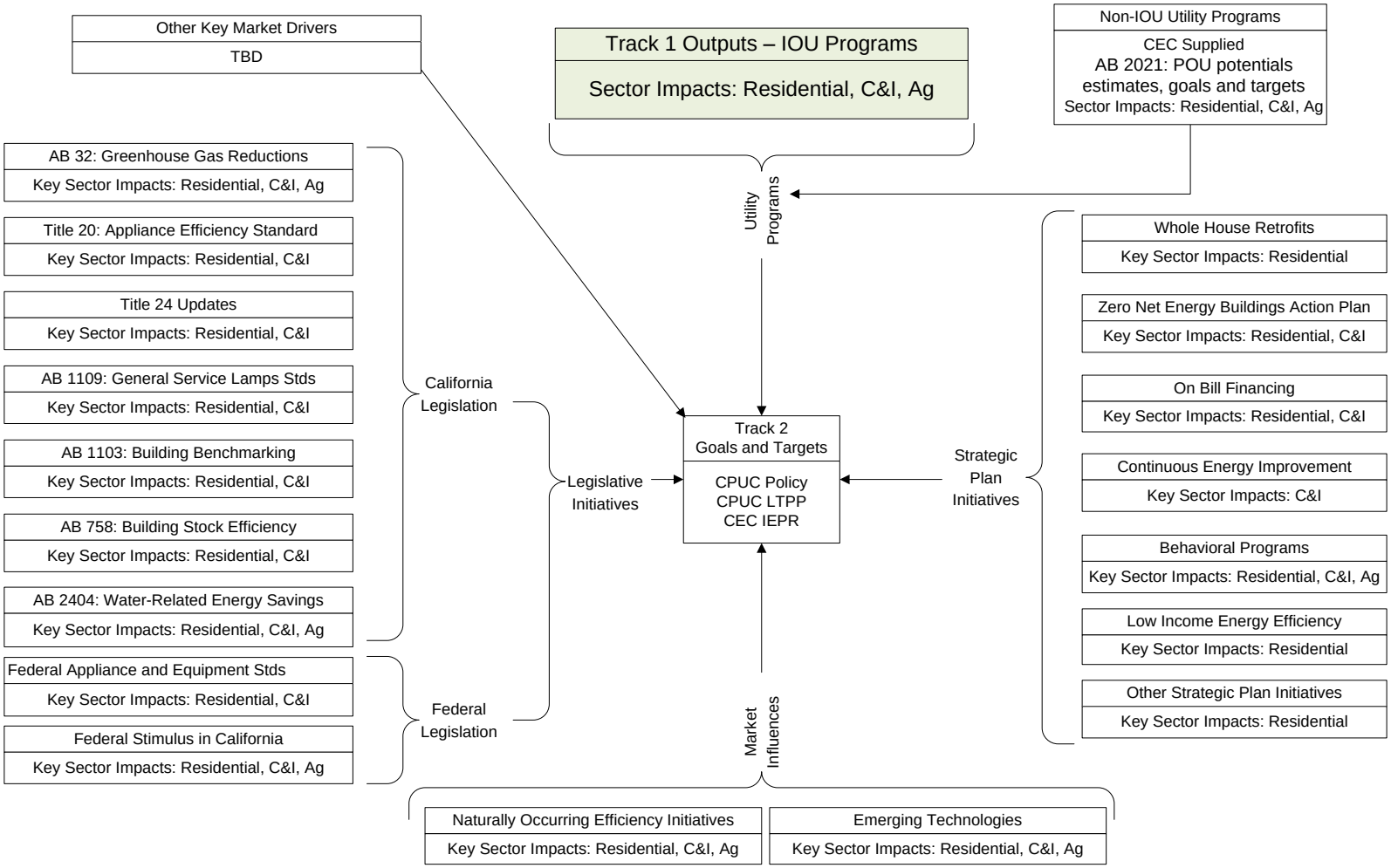
3.2.1 Identify and Analyze Key Market Drivers

This step will identify market drivers that may impact the Total Market Gross, including:

- Legislation at the state and federal levels (including codes and standards and federal stimulus funds),
- Utility programs,
- Market influences (including emerging technologies and "naturally occurring" energy savings), and
- Individual Strategic Plan initiatives.

Figure 3 captures the types of Key Market Drivers that the project team will analyze.

Figure 3. Categories of Key Market Drivers



The project team will develop a template to compile information for each High Impact Initiative[2] from the Strategic Plan and each key market driver. This template will also serve as the beginning of the framework for data input into the model. The template may include the following information:

- An overall description,
- Determination of which sectors the driver will affect (i.e., residential, commercial, etc.),
- Priority delivery mechanisms, and
- The extent to which the savings associated with a given driver will overlap with savings from other drivers (high/medium/low).

Task 3.2.1 Deliverables:

1. List of KMDs for analysis
2. Memo describing template for analysis

3.2.2 Evaluate Savings from Key Market Drivers

The project team will develop a bottom-up estimate of the technical potential for each driver. The team will utilize existing assumptions and estimated savings for each strategy where available or will develop new estimates of driver savings, as required. As discussed in Task 4.1, the team will disaggregate savings estimates into the appropriate sectors. The team will carefully consider the unique characteristics of each driver to calculate its technical potential.

The project team will develop a model to support evaluation of driver savings. The core of the model will compute the transient effects of technology diffusion to ensure that goals and targets can be realistically met within the specified time frame. Other effects such as behavior and market transformation will also be modeled. Then the technologies and behavior changes will be mapped to the various drivers (i.e., codes and standards, legislation, policy, IOU programs, and strategic initiatives), and savings will be attributed to each driver based on driver prioritization and driver overlap. A graphical user interface will allow selection of various scenarios and will provide the user the ability to adjust key parameters to assess portfolio performance and determine the appropriate levels for goals and targets.

The model development process shown below presents an accelerated effort to develop the model and its inputs and to refine the model through testing.

1. Acquire/understand SESAT model
2. Define general model requirements (goal of the model, inputs, outputs, attributes, user interface, etc.)
3. Define model design approach (leveraging SESAT structure where appropriate)
4. Develop model structure with preliminary placeholder input values
5. Develop model inputs (complete by August 15th)
    a. Receive Track 2 KMD input parameters
    b. Receive Track 1 outputs

[2] See Section 3.2.2.2for additional discussion on the selection of High Impact Initiatives.

c. Assess attribution assumptions to avoid double counting

6. Testing and Refinement
   a. Evaluate outputs
   b. Refine model structure as needed
   c. Calibrate model to SESAT and/or other data sources
7. Working Draft Model (complete by September 1st)
8. Run model scenarios and develop output graphs and data tables (complete by October 15th)
9. Adjust model as needed (based on draft report feedback) and run final scenarios.

The following sections outline the approaches that the team will use to calculate savings from each of the key areas of KMDs:

- Section **Error! Reference source not found.** discusses the approach to calculating savings from IOU programs,
- Section 3.2.2.2 discusses the approach to calculating savings from Strategic Plan initiatives,
- Section 3.2.2.3 discusses the approach to calculating savings from legislative initiatives,
- Section 3.2.2.4 discusses the approach to calculating savings from non-IOU utility programs,
- Section 3.2.2.5 discusses the approach to calculating savings from emerging technologies, and
- Section 3.2.2.6 discusses the approach to calculating savings from naturally occurring savings.

3.2.2.1 IOU Programs Savings Estimates

The Track 1 team will model IOU program energy savings using Navigant's EERAM model (previously described in Section 2). As discussed, the EERAM model is capable of calculating the technical, economic, and market potential disaggregated by sector and HIM. Navigant will use the outputs from Track 1 as inputs to this part of Track 2.

3.2.2.2 Strategic Plan Initiatives Savings Estimates

Accounting for the energy savings from the *Strategic Plan* will involve a closer look at a subset of the initiatives as determined by an initial screen. After determining the current status of the *Strategic Plan* initiatives, the project team will develop a set of criteria for identifying the *Strategic Plan* initiatives with the most significant opportunities to create energy savings. The project team will categorize each driver as "most likely," "may be likely," or "not likely" of having savings impacts over the planning period. The screening process will use multiple criteria to score each driver. Parameters could include technical potential, cost effectiveness, market readiness, and legislative feasibility. The project team will develop the screening process, including selection of screening criteria, with input from KEMA, the CPUC and relevant Subject Matter Experts. This process will identify the Key Market Drivers (KMD) on which to focus further study analyses.

The team will identify "High-Impact Strategic Plan Initiatives" and focus the remainder of its analysis on them. This approach will enable the team to conduct the analysis at a sufficient level of depth. (Given the bottom-up nature of the approach used in Track 2, focusing on a subset of the initiatives is necessary.) Once the screen is conducted, the team will move forward with the attribution analysis outlined in Task 3.2.3 and the development of the technical potential estimates.

The key steps that will be taken to analyze the savings potential are listed below:

1. Assess status of Strategic Plan initiatives (following the methodology outlined in Task 3.2.7)[3]
2. Identify High-Impact *Strategic Plan* Initiatives (SP Market Drivers)
    a. Develop SP MDs evaluation screen criteria
    b. Analyze SP according to screen criteria
    c. Review with Track 2 Team
3. Assess Attribution for High-Impact *Strategic Plan* Initiatives (using the approach in Task 3.2.7)
4. Estimate the technical potential of the High-Impact Initiatives
5. Develop model inputs for unique SP MDs, submit to modeling team
6. Quantify technical potential of SP MDs
7. Apply cost effectiveness screen to identify SP KMDs

When possible, the project team will reference existing analysis and models previously used to analyze strategic initiatives. For example, in 2009 Navigant analyzed the Existing Homes Initiative using home energy modeling software for the CEC's PIER Buildings Program. Similar modeling may be useful for the Zero Net Energy Homes, Whole House Retrofits, and Low Income Energy Efficiency initiatives.

Task 3.2.2.2 Deliverables:

1. *Strategic Plan* initiative status memo
2. Memo summarizing methodology for screening *Strategic Plan* initiatives to identify High-Impact Initiatives
3. List of High-Impact Initiatives
4. *Strategic Plan* model inputs

3.2.2.3 Legislative Initiatives Savings

The team will use a bottom-up approach to estimate savings associated with specific legislation. Since Track 1 includes legislative impacts in the baseline calculation, the project team will use the same methodology for each respective legislative piece used by EERAM. New analysis in Track 2 will explore the impacts of the legislation in two contexts:

1. Covered in the Track 1 model in non-IOU service territories.
2. AB 758 and any other legislation that may contribute to the Total Market Gross that is not already accounted for in the Track 1 savings

This analysis will focus on existing legislative initiatives; it will not include forecasts of new legislation that may or may not be adopted during the study period.

The Track 2 team will conduct a review and update of the approach used in the SESAT model for incorporating codes and standards.

[3] The team will use existing and/or modified definition of market transformation as part of the categorization process for the *Strategic Plan* initiatives.

The schedule and deliverables for analysis of Legislative and Federal Initiatives will be consistent across all legislative initiatives. The project team will coordinate with relevant parties at each step, including CPUC, KEMA, CEC, and others deemed appropriate by CPUC.

Action Items:

1. Review relevant literature related to initiative to determine current status of the initiative.
2. Meet with relevant experts on each initiative to discuss energy savings estimates from each legislative initiative and assess overlap with other KMDs
3. Quantify estimated savings of each initiative
4. Complete template provided for input into model for each initiative

Key Deliverables:

1. Memo summarizing and providing current status of each initiative per the literature review
2. Memo summarizing meetings with relevant experts for each initiative
3. Savings estimates for each initiative
4. Final, completed template for the model

3.2.2.4 Non-IOU Program Savings Estimates

For any KMDs that include non-IOU savings, Navigant proposes to exclude these savings where possible, or decrement the savings associated with the non-IOU territory where statewide estimates do not disaggregate data at the service utility territory level. If it is necessary to decrement savings, Navigant will look to data sources, such as the estimates on investor and publicly owned utility shares of California's electricity consumption provided by IEPR or other broadly accepted sources for guidance in how values will be decremented.

3.2.2.5 Emerging Technologies

The impacts of Emerging Technologies (ET) can be accounted for in both Track 1 and Track 2. In Track 1, a subset of market-ready emerging technologies will be modeled in Navigant's EERAM tool for the California IOUs. If an emerging technology is applicable to a particular driver within Track 2, a portion of its savings can be attributed to that driver and modeled in that driver's analysis. For example, in-home energy displays and cold water default washers may be examined as part of Behavioral Programs Driver under the Strategic Plan Initiatives.

Following review of all emerging technologies for possible inclusion in other drivers (including Track 1), the remaining subset of emerging technologies will be analyzed for their Total Market Gross in California. Appendix 4.2 includes a preliminary list of ETs under consideration to be included in this analysis.

Navigant may need an approach to accurately estimate the market adoption of emerging technologies over the study period. A key consideration is the changing rate at which emerging technologies penetrate the market. The team will use a combination of two approaches to model emerging technology impact, as appropriate for each technology:

The team will develop three key types of inputs:

1. **Cost Curves:** Where data exist, the team will include curves to model the anticipated decrease in technology-specific costs over time.

2. **Efficiency Curves:** Where data exist, the team will use forecasted improvements in efficiency for key ETs. A classic example of technology with an existing efficiency curve is the LED.[4]
3. **Discount Factor:** The team will use historic data to create a "discount factor" for anticipated savings associated with ETs. The 2006 California Energy Efficiency Potential Study forecasted the technical and market potential of a group of emerging technologies in the California IOU utility service territories through 2016. Penetration for emerging technologies was estimated similarly to that of conventional technologies. The team will compare the 2006 projections against actual program savings from emerging technologies in IOU programs from 2006-2010. This comparison will demonstrate the extent to which ET penetration deviates from that of conventional technology. The resulting "discount factor" will be applied to the energy savings estimates targeted for the technologies selected for analysis.

The market penetration of new technologies has been shown to follow a certain trend and can be modeled using a Bass Diffusion curve. These market penetration curves will be used in Navigant's Track 2 model. Modeling ETs in Track 2 will utilize the same algorithms that the model employs for the mainstream technologies.

Action items:

1. Conduct a pre-screen on Navigant's database of ETs to determine which ones warrant further analysis
2. Develop template for model inputs
3. Characterize selected ETs according to cost, lifetime, unit savings, and sector
4. Develop assumptions about cost curves and discount factors
5. Integrate into related KMD
6. Coordinate with Track 1
7. Provide inputs to Track 2 model

Key Deliverables:

1. Draft and revised memo summarizing the approach to screen and characterize ETs
2. List of ETs selected for further analysis
3. Inputs to the model

3.2.2.6 Naturally Occurring Savings

In addition to the savings that are achievable from HIMs and secondary measures analyzed, additional naturally occurring savings may exist from both types of sources. These naturally occurring savings are driven by factors outside the key market drivers. Savings attributed to naturally occurring savings have previously been calculated using the arithmetic complement to the Net-To-Gross (NTG) ratio.[5]

However, issues of price responsiveness and price elasticity related to consumer behavior have been raised as key issues for coordination of CEC's forecasting modeling approaches and CPUC's potential, goals, and targets study from 2008. Additionally, review of issues related to participant and non-participant spillover, analysis of savings directly attributable to programs, NTG, and non-participant

[4] Navigant Consulting. 2010. *Energy Savings Potential of Solid-State Lighting in General Illumination Applications 2010 to 2030.* Prepared for U.S. Department of Energy.

[5] If the NTG is 0.85, the arithmetic complement is 1.0 - 0.85 = 0.15

actions will inform the final approach to calculating naturally occurring energy savings. Figure 4 describes these types of energy savings that are achieved over the life of a utility program. This process will include deliberations with relevant stakeholders.

Figure 4. Attribution of Energy Savings

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Key Deliverables:

1. Draft and revised memos explaining approach (revised version to address CPUC, KEMA and other relevant Subject Matter Expert comments)

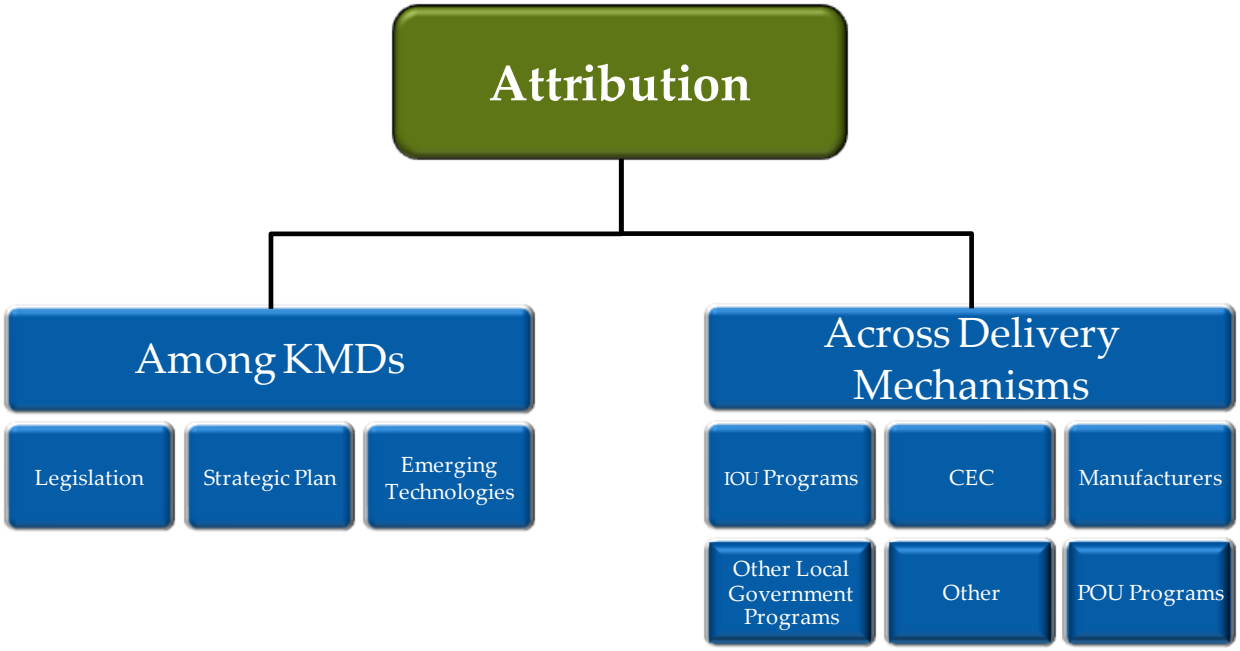
3.2.3 Assess Attribution Assumptions

Many of the KMDs are cross cutting and may create effects that overlap with one another. A key step to properly estimating the Total Market Gross is to understand the areas in which drivers may interact or overlap and savings could be double counted.

The project team is considering attribution from two different perspectives, as shown in Figure 5Figure 4.. First, the project team will determine the extent to which each KMD is responsible for generating energy savings. Attribution among KMDs will enable the CPUC to assess the effects of promoting certain KMDs in a more focused manner than others; if any KMD was to be significantly altered or discontinued energy savings may be affected to a greater or lesser extent, depending on the KMD. This part of the analysis will award attribution to the most direct driver for the savings. In cases in which multiple drivers influence a category of energy savings, the project team will consider factors such as the scope of each driver's influence, the extent to which a driver compels action, and the order in which the drivers were adopted. For example, legal mandates that affect entire supply chains (e.g., federal standards) are viewed as direct drivers because they compel action rather than incentivize it.

The second aspect of attribution relates to the delivery mechanisms that will be held responsible for the savings. This part of the analysis will enable CPUC to identify which entities will deliver the energy savings and to set the goals and targets accordingly. Different delivery mechanisms may be appropriate in different circumstances, and this part of the analysis will consider those circumstances. The team will determine the appropriate delivery mechanism by a variety of factors, such as existing programmatic efforts, the stage of a technology's market adoption, and the practical aspects of implementation.

Figure 5. Two Components of Attribution



To determine attribution along each of these dimensions, the project team will undertake the following activities:

1. Develop and fill out a template for identifying which KMDs create overlapping energy savings.[6]
2. Develop a methodology for distributing the energy savings across delivery mechanisms. The methodology will incorporate the factors described earlier in this section.
3. Conduct a thorough vetting of the methodology with KEMA, the CPUC and relevant Subject Matter Experts.
4. Implement the methodology for distributing the savings that is agreed upon by KEMA, the CPUC, and other Subject Matter Experts.

   At this time, it is unclear how this approach to attribution compares to the 2008 study. The 2008 study reported that Itron modeled savings as penetration-weighted technical potential. The report indicated that it was difficult to forecast the savings attributable to particular actors or particular mechanisms. The project team will work with Itron to gain a better understanding of the methodology that Itron used in the 2008 study.

Key Deliverables:

1. Draft and revise memos summarizing the methodology and the supporting assumptions that will be used to distribute the energy savings across delivery mechanism

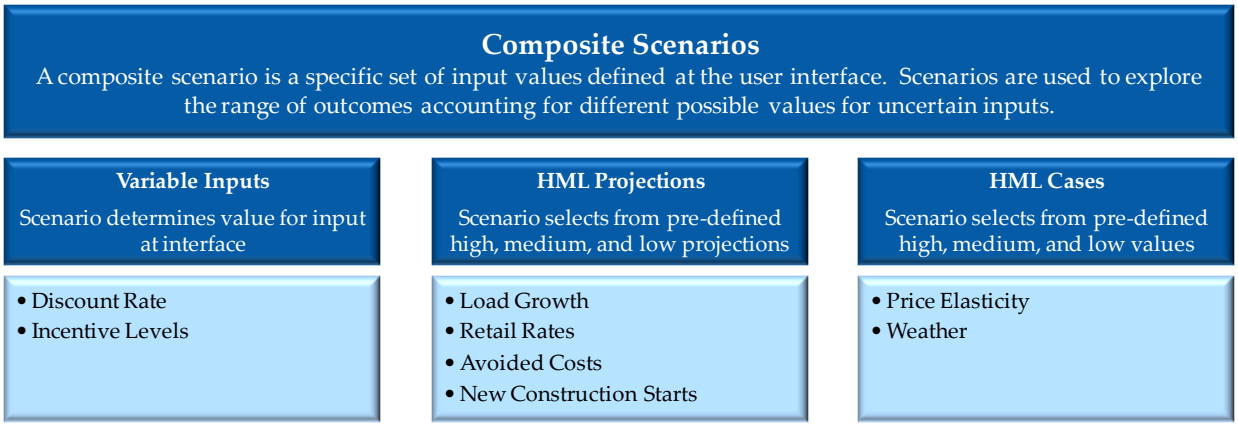
[6] The teams analyzing each area of drivers (e.g., IOU, POU, legislation, *Strategic Plan)* will be responsible for an initial assessment of overlap for the KMDs in their area. For further discussion about the issue of attribution related to Naturally Occurring savings, please see section 3.2.2.6 **Error! Reference source not found.**.

3.2.4 Evaluate Key Market Driver Savings – Achievable Savings Scenarios

The project team will develop three scenarios to serve as the framework for analyzing the achievable and market savings. Achievable savings for each key driver will focus on estimating potential savings under "high" "medium" and "low" market conditions. The project team will incorporate technical and economic potential data from the Track 1 modeling effort that also may include modeling various market and economic variables.

Figure 3-5 describes a consistent nomenclature for describing the scenarios that the Track 2 effort will incorporate. Composite Scenarios include a defined set of values for a given set of variables; the Composite Scenarios will be used to frame the discussion about goals and targets. Variable Inputs are the values provided for the set of variables in a specific scenario. Certain variables will include a range of projected values over a given period of time, defined as High/Medium/Low HML) Projections. The HML Cases are point estimates for certain variables, which stay constant throughout the duration of the study period.

Figure 6. Framework for Describing Scenarios



Navigant will determine the possible values for each Variable Input based on information available from the CPUC, CEC, DOE, the California IOUs, and other publicly vetted sources. This approach will enable the project team to address uncertainty by allowing multiple values for certain key inputs. Navigant will develop three values for each (high, medium, and low) key input that represent the likely range of possible values. Where the organizations providing the data have already developed these HML values, Navigant will use those. Where relevant, the Track 2 team will use the same sources as those used in the Track 1 modeling (e.g., energy price forecasts); those values will have been vetted through the Track 1 effort. The following sources are planned for certain key Variable Inputs:

- **Energy prices**: California Energy Commission Integrated Energy Policy Report 2011
- **Avoided Costs**: E3
- **Discount Rates**: Each of the IOUs
- **Housing and C&I building stock**: California Energy Commission Integrated Energy Policy Report 2011
- **Load Forecasts:** California Energy Commission Integrated Energy Policy Report 2011
- **Population**: California Department of Finance
- **Economic Growth Indicators (GDP)**: California Department of Finance

- **Measure Incentive Levels**: Will follow the levels modeled in the 2008 Itron study and will expand to other methods
- **Price Elasticity and Price Effects:** California Energy Commission and literature review

Any given run of the model will require selecting a high, medium, or low case for each key input. The collective combination of the selected cases across all of the key inputs for a given model run is referred to as a Composite Scenario. The project team anticipates developing 12 composite scenarios. These will include the three typical scenarios where all inputs are set to their high, medium, and low case values to demonstrate the expected outcome and the range of possible outcomes. However, these three scenarios do not illustrate the likelihood of these outcomes. The other nine scenarios will allow for different combinations of key input cases, which should demonstrate whether or not results tend to cluster around a particular outcome, giving an indication of the likelihoods for range outcomes.

When assembling Composite Scenarios, care will be taken to develop realistic and reasonable combinations of input variables since it is possible that some of the Variable Inputs are in fact dependant on or correlated with other variables. For example, avoided cost and energy price may be related, and selecting their input values may require coordination. Navigant will take these factors into account when developing the values for each Composite Scenario.

At a stakeholder meeting in July 2011[7], staff members from the CEC indicated that the CEC's statewide energy load growth forecasts assume a set of values for economic and demographic variables. Navigant proposes at a minimum to run a set of Composite Scenarios for the Potentials Goals and Targets Study that uses the same assumptions that the CEC load forecast used in its scenarios. This will allow the PG&T study to remain consistent with CEC work and will enable the results to be compared to CEC load forecasts for purposes of goal setting. Additional scenarios beyond those defined by the CEC load forecasts can also be explored by Navigant to test the sensitivity of key variables and provide the readers a better understanding of the possible levels of energy efficiency.

Given the three scenarios, the project team will evaluate the market achievable savings potential from each of the KMDs identified through sections 3.2.2.1 through 3.2.2.6. Where appropriate, the 2011 study will incorporate the approach used in the 2008 Goals and Targets Study. For example, the 2008 study defined the "high" savings case as "difficult but feasible", while "mid" and "low" savings cases were more conservative based on trajectories of performance and market penetration milestones that were more modest and gradual over time.

Key Deliverables:

1. Draft a revised memo summarizing the three scenarios (revision to incorporate feedback from KEMA, CPUC, and others deemed appropriate by CPUC)
2. Achievable Savings under each of the three scenarios

3.2.5 Define Relationship between Measures and Key Market Drivers

It is expected that a few core technologies will account for the majority of the savings for each key driver. Navigant will focus on identifying these core technologies (high impact measures). The team will conduct analysis as needed to disaggregate the total savings from KMDs to its component measures. For example Zero-Net-Energy-Homes energy savings may be heavily driven by savings from weatherization, HVAC system improvements, and passive solar lighting. The team will determine what portion of the total savings is realized from each of these technologies.

[7] The project team attended a meeting with the Demand Analysis Working Group (DAWG) on July 14, 2011.

The selection of the HIMs and Secondary Measures[8] will begin with the list created as part of the Track 1 effort. The team will identify additional HIMs and Secondary Measures as appropriate part of Task 3.2.7 as the team reviews the savings from Legislative and *Strategic Plan* initiatives. Navigant will compile a list of the high impact measures, document their energy savings, and attribute their savings to an appropriate sector or subsector. It is possible that a few cross-cutting high impact measures appear across various drivers. If so these will be identified and their Total Market Gross will be reported.

Task 3.2.5 Deliverables:

1. List of HIMs and Secondary Measures associated with relevant KMDs along with references to the source of savings assumptions

3.2.6 Calculate Total Market Gross Savings from Key Market Drivers

Navigant will develop estimates of Total Market Gross Savings expected over the study period to be captured by KMDs. This analysis will include the total and sector level potential energy savings (electric and natural gas) for each Key Market Driver with accompanying percentage breakdown of the potential contribution to Total Market Gross Potential, as shown in Table 1.

Task 3.2.5 Deliverables:

Navigant provide a table that breaks out the projected Total Market Gross Energy Savings by KMD and sector, as illustrate in the table below.

Table 1. Illustrative Example - Table of Total Market Gross Energy Efficiency Savings

Total Statewide Market Potential Table of Savings Opportunities								
	Residential		Commercial		Industrial		Agricultural	
Key Market Driver/Sector Savings	kwh/KW therms	% of sector	kwh/KW therms	% of sector	kwh/KW therms	% of sector	kwh/KW therms	% of sector
1. Legislative Initiatives								
Title 24 Update	.							
AB 2402: Water Related Energy Savings								
AB 32: Greenhouse Gas Reductions								
AB 2021: POU potentials estimates, goals and targets								
Reach Codes and the new								

[8] In this context, Secondary Measures refer to "second-tier" measures, which may have impact, for instance, when combined with other measures.

Total Statewide Market Potential Table of Savings Opportunities								
	Residential		Commercial		Industrial		Agricultural	
Key Market Driver/Sector Savings	kwh/KW therms	% of sector	kwh/KW therms	% of sector	kwh/KW therms	% of sector	kwh/KW therms	% of sector
CALGreen Code Actions								
Title 20: Appliance Efficiency Standards								
AB 1109: General Service Lamps								
AB 1103: Commercial Building Benchmarking								
AB 758: Comprehensive Energy Savings in Existing Building Stock								
2. Utility Programs								
IOU Programs								
Non-IOU Programs								
3. Market Influences								
Emerging Technology Influences								
Naturally Occurring Energy Savings								
4. California Long-term Strategic Plan Initiatives/ Strategies								
Whole House Retrofits								
Zero Net Energy Buildings Action Plan								
On Bill Financing								
Continuous Energy Improvement								
Behavior Programs								
Low Income Energy								

Total Statewide Market Potential Table of Savings Opportunities								
	Residential		Commercial		Industrial		Agricultural	
Key Market Driver/Sector Savings	kwh/KW therms	% of sector	kwh/KW therms	% of sector	kwh/KW therms	% of sector	kwh/KW therms	% of sector
Efficiency								
Other Strategic Plan Initiatives								

3.2.7 Develop a CPUC Goals and Targets Strategic Planning Measurement Framework

Navigant will use the results of the analysis described in this work plan to create three key outputs. These outputs will update the outputs of the SESAT Model[9] as well as provide adjustments and improvements, based on comments on the 2008 Study. The Goals Study Update will generate scenarios and contain the following attributes:

- Develops a more detailed Strategic Plan analyses for key *Strategic Plan* initiatives
- Reviews CEC forecast assumptions for possible crossover
- Breaks down Total Market Gross Potential by sector and IOU service territory
- Identifies key delivery mechanisms by sector
- Provides a simple incentive level scenario results viewer with relevant composite scenarios
- Develops a Strategic Plan categorization planning framework

The model will serve as a CPUC Goals and Targets Strategic Planning Framework and will incorporate the following three elements:

1. Total Market Gross Energy Efficiency Savings (TMG-TS) (See Table 1 above.)
   a. Navigant will utilize results from the previous task analyses to populate Table of Savings and develop percentage savings profiles for each KMD.
   b. Breakdown of technologies by sectors and IOU territories
   c. Policy implications assessment utilizing two funding scenarios for (laid on top of each of the scenarios) using a 50% incremental cost as the base (base restricted funding scenario) and another one using a 100% incremental cost base (full restricted funding scenario)
   d. The table will provide an overall estimate of Total Market Gross utilizing the "medium" scenario of savings from the "achievable" savings scenario modeling undertaken in Task 3.2.4. An appendix with tables representing "high" and "low" achievable savings will be provided
2. A Total Market Gross Scenarios "What if" Calculator (TMG-C)

   Navigant will develop a simplified, interactive calculator that incorporates the results of Track 2 analyses. The calculator will integrate two modules to provide policymakers with different

[9] SESAT stands for Scenario-based Energy Savings Assessment Tool. SESAT is the model that Itron used in the 2007 Goals and Potentials study. Additional detail can be found in the report: Itron. 2007. *Assistance in Updating the Energy Efficiency Savings Goals for 2012 and Beyond.* Prepared for CPUC.

perspectives on portfolio funding, incremental cost options, and impacts. Descriptions of each module follow:

a. Simplified switches. The first module will focus on the Composite Scenarios (described in Section 3.2.3). Through this module, the calculator will allow planners the ability to:

   i. Turn "on" and "off" certain drivers

   ii. Adjust overall economic factors

   iii. Switch between the high medium and low scenarios

b. Incentives varied by stage of technology diffusion. This second module will enable decision makers to examine how market adoption shifts when incentive levels differ based on the stage of market adoption for classes of technologies. This module provides decision makers with the information needed to determine the extent to which market adoption of energy-efficient technologies can be accelerated with higher incentive levels. The key features of this Diffusion Model include the following:

   - A four-category technology saturation model that identifies the current saturation of each of the HIMs. The categories would be: (1) emerging technology; (2) technologies with less than about 15 or 20% of market share; (3) mid-mature technologies; and (4) mature technologies
   - Policy evaluation of three different incentive level scenarios[10] for technology grouping. The policy evaluation will consider:
     - the level of incremental cost funding that might be allocated to each technology based on their place on the maturity curve;
     - the maturity of the technology;
     - the technology's importance in projected overall savings over the course of the study period (based on the overall Track 2 analysis).
   - Evaluation of sliding scale of TRC based on level of technology market maturity
   - Policy discussion of the implications of key scenarios

3. Strategic Plan Initiative Classification and Performance Measurement Structure that incorporates the key elements of our Strategic Plan initiatives analyses, including a formal categorization structure

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[10] The following three incentive level scenarios may be considered for this analysis:

- ***Rates Increase Scenario (A)*** – Incremental cost funding for Categories #1 and #2 is equal to 100-110% of incremental cost; Incremental cost funding for Categories #3 and #4 is equal to 50% incremental cost funding (impact= higher rates to "supercharge" implementation of HIMs that are not currently in the mainstream of the market; assumes that Category #4 technologies are targeted for code integration)
- ***Flat Rates Scenario (B)*** – Incremental cost funding is held at 100% for Categories #1 and #2; Incentives for Category #3 are reduced by about 10 percent; incentives for Category #4 are reduced by 25% (or Category #3 and #4 incentive reductions are equivalent to that which would be needed to keep the overall rates impact of the package flat
- ***Business As Usual Rate Scenario (C)*** – incremental cost savings are Incremental cost funding is held at 50% for categories of technologies

from which to consistently identify each initiative for evaluation. In addition, the structure will provide a Performance Measurement Structure that may be used by the CPUC to inform its evaluation policy and decision making.

3.3 Reporting

The project team will deliver a draft report to the CPUC and KEMA by December 12, 2011. The draft report will include the following elements:

1. A description of the methodologies employed to develop the Goals and Targets framework
2. Analysis of the policy implications of the key scenarios analyzed in the Track 2 model
3. Total Market Gross Table of Savings for key scenarios
4. Additional appendices including supporting documentation

Much of the report will have been previously provided to CPUC and KEMA through the interim deliverables; these will be incorporated into the report or the appendices as appropriate.

Key Deliverables:

1. Final report to CPUC and KEMA by December 12, 2011
2. Final report (incorporating CPUC and KEMA comments) by December 21, 2011.

4 Appendices

4.1 *Appendix A: 2006-2008 EM&V Reports*

Table 2: 2006 – 2008 Evaluation Groups and HIM Topics Relevant to Track 1 Analysis

2006 - 2008 EM&V study	*HIM Coverage*
New Construction/ Codes & Standards	Whole Building
Residential Retrofit/Upstream Lighting	CFL, Outdoor CFL, Clothes Washer, Insulation, Interior Screw Lighting, Linear Fluorescent, Pool Pump, Refrig. Recycling, Room AC, Dishwashers, Furnaces, High Eff. Gas Water Heaters, Low- flow shower aerators
Commercial Retro- commissioning	Retro- commissioning
Major Commercial	On- site Audit, custom lighting, custom HVAC, custom other
Small Commercial	High- bay fluorescent
Specialized Commercial	Refrigerant Charge Airflow, AC replacement, Duct Sealing
Commercial Facilities	Refrigeration Door Gasket and Strip Curtains
PG&E Agricultural & Food Processing	Greenhouse Heat Curtains and IR Film
PG&E Fabrication, Process & Manuf.	Pump- off controllers
SCE Industrial & Agriculture	Pump tests, Steam Traps, Pipe Insulation

Table 3: Key 2006 – 2008 Evaluation Reports and Study Topics Relevant to Track 1 Analysis

2006 - 2008 Market Effects Studies
CFL Market Effects
High Bay Lighting
New Construction
2006 - 2008 Behavior Studies and Topics
Energy efficiency potential studies and behavior
Measurement and evaluation of energy savings and non- energy impacts from energy efficiency behaviors
Process evaluation's insights on energy efficiency program implementation
Behavioral assumptions underlying energy efficiency nonresidential programs
Behavioral assumptions underlying energy efficiency residential programs
Market segmentation and energy efficiency program design
Experimental design for energy efficiency programs
Motivating policymakers, program administrators, and implementers to pursue behavioral change strategies
Encouraging greater innovation in the production of energy- efficient technologies and services.
2006 – 2008 IOU Market Assessment Studies
Market Baseline Study of the Business and Consumer Electronics Program
Target Market Customer Survey
Codes and Standards Market Adoption Estimation Methods
Codes & Standards PE/MA
Sustainable Communities PE/MA

California New Homes PE/MA
Savings by Design PE/MA
2006 Residential Market Share Tracking

Table 4: Links to the 2006 – 2008 Evaluation Reports

Non- Residential New Construction
http://www.calmac.org/publications/NRNC_Final_Report_02082010.pdf
http://calmac.org/publications/NRNC_Appendices_Part1_02082010.pdf
http://www.calmac.org/publications/NRNC_Appendices_Part2_02082010.pdf
Residential New Construction
http://www.calmac.org/publications/RNC_Final_Evaluation_Report.pdf
http://www.calmac.org/publications/RNC_Appendices_Vol_I_02- 19- 10.pdf
Residential Retrofit/Upstream Lighting
http://www.calmac.org/publications/FinalResidentialRetroEvaluationReport_11.pdf
http://www.calmac.org/publications/FinalResidentialRetroEvaluationAppendices.pdf
http://calmac.org/publications/FinalUpstreamLightingEvaluationReport_Vol1_CALMAC_3.pdf
http://calmac.org/publications/FinalUpstreamLightingEvaluationReport_Vol2_CALMAC.pdf
Commercial Retro- commissioning
http://www.calmac.org/publications/RCx_2006- 08_EM&V_Report_FINAL.pdf
http://www.calmac.org/publications/RCx_2006- 08_EM&V_Report_FINAL_-_Vol_1.zip
http://www.calmac.org/publications/RCx_2006- 08_EM&V_Report_FINAL_-_Vol_2.zip
http://www.calmac.org/publications/RCx_2006- 08_EM&V_Report_FINAL_-_Vol_3.zip
Local Government Partnerships
http://www.calmac.org/publications/06- 08_Government_Partnerships_Programs_Direct_Impact_Evaluation_Report.pdf
http://www.calmac.org/publications/LGP_Evaluation_Report_Appendix_Volume_1_-_Appendices_A_-_D.pdf
http://www.calmac.org/publications/LGP_Evaluation_Report_Appendix_Volume_2_-_Appendices_E_-_I.pdf
http://www.calmac.org/publications/Local_Government_Partnership_Non-Resource_Evaluation_Report-FINAL_1262010v2_km.pdf
http://www.calmac.org/publications/Local_Government_Partnership_Non-Resource_Evaluation_Appendices-FINAL_1262010_km.pdf
Major Commercial
http://www.calmac.org/publications/Major_Commercial_2006- 08_EM&V_Report_FINAL_-_VOL_1.pdf
http://www.calmac.org/publications/Major_Commercial_2006- 08_EM&V_Report_FINAL_-_VOL_2a.zip
http://www.calmac.org/publications/Major_Commercial_2006- 08_EM&V_Report_FINAL_-_VOL_2b.zip
Small Commercial
http://www.calmac.org/publications/Report_NoApps.pdf
http://www.calmac.org/publications/Report_AppsA- D.pdf
http://www.calmac.org/publications/Report_AppsE- M.pdf
Specialized Commercial
http://www.calmac.org/publications/Vol_1_HVAC_Spec_Comm_Report_02- 10- 10.pdf
http://www.calmac.org/publications/Vol_2_Specialized_Commercial_Report_APPENDICES_02-10-10.pdf
Commercial Facilities
http://www.calmac.org/publications/ComFac_Evaluation_V1_Final_Report_02- 18- 2010.pdf

PGE Agricultural & Food Processing
http://www.calmac.org/publications/PG&E_Ag-_Food_Eval_Report_V1_021010.pdf
http://www.calmac.org/publications/PG&E_Ag-_Food_Eval_Appendices_V2_021010.pdf
http://www.calmac.org/publications/PG&E_Ag-Food_Eval_Appendices_V4_Public_Comments-Responses_021010.pdf
PGE Fabrication, Process & Manuf.
http://calmac.org/publications/PG&E_Fab_06-_08_Eval_Final_Report.pdf
http://calmac.org/publications/PG&E_Fab_06-_08_Eval_Final_Report_Appendices.pdf
SCE Industrial & Agriculture
http://calmac.org/publications/SCIA_06-_08_Eval_Final_Report.pdf
http://www.calmac.org/publications/SCIA_06-_08_Final_Report_Appendices-_No-_Site_Reports.pdf
Codes and Standards
http://www.calmac.org/publications/Codes_Standards_Vol_III_FinalEvaluationReportUpdated_04122010.pdf
http://www.calmac.org/publications/CS_AppendicesUpdated_04-_12-_2010.pdf
Emerging Technologies
http://www.calmac.org/publications/Final_Comprehensive_ETP_Final_Report_02-_04-_10_R7_3.pdf
http://www.calmac.org/publications/Final_Comprehensive_ETP_Final_Report_Appendices_02-_04-_10_R3.pdf
Statewide Marketing/Outreach
http://www.calmac.org/publications/CPUC_SWMO_Integrated_Indirect_Impact_Report_VolI_022410.pdf
http://www.calmac.org/publications/CPUC_SWMO_Integrated_Indirect_Impact_Report_VolII_121809.pdf
Statewide EE Education/Training
http://calmac.org/publications/06-_08_Statewide_Education_and_Training_Impact_Eval_Vol_I_FINAL.pdf
http://calmac.org/publications/06-_08_Statewide_Education_and_Training_Impact_Eval_Vol_II__FINAL.pdf
http://calmac.org/publications/06-_08_Statewide_Edcuation_and_Training_Impact_Eval_Vol_III_FINAL.pdf
http://calmac.org/publications/06-_08_Statewide_Education_and_Traning_Impact_Eval_Vol_IV_FINAL.pdf
Education and Information
http://www.calmac.org/publications/ODC_CPUC_0608_Edu_and_Info_Impact_Eva_VoI_Final.pdf
http://www.calmac.org/publications/ODC_CPUC_0608_Edu_and_Info_Impact_Eva_VoII_Final.pdf
http://www.calmac.org/publications/ODC_CPUC_0608_Edu_and_Info_Impact_Eva_VoIII_Final.pdf

4.2 *Appendix B: Emerging Technologies*

Table 5 provides a list of high priority emerging technologies under review for possible inclusion in the potential study.

Table 5. High Priority Emerging Technologies Under Review

Electric/Gas	Segment	Category	Name	Description
Electric	R/C	Other	Voltage Regulation Products	Utilities in the US are required to deliver power to consumers at 120 volts plus or minus 5%, which yields a range of 114 to 126 volts. MicroPlanet's Energy Conservation products save energy and improve service quality by delivering optimum voltage levels. MicroPlanet's advanced technology can reduce electricity usage from 5-12% in many residential and commercial locations by monitoring and dynamically adjusting incoming line voltage.
Electric	R/C	HVAC	Ice Storage A/C	An ice storage A/C module is paired with a condensing unit used to freeze water in an insulated storage tank. It operates the condensing unit at night, when energy is less costly. During the day when the thermostat calls for cooling, standard refrigerant is circulated through coils in the ice. The chilled refrigerant then flows to the building's air-conditioning system inside the home or business to provide immediate, efficient cooling. This can reduce building peak demand associated with cooling by up to 95% because the peak demand setting condensing unit is off during the day.
Electric	R	HVAC	Residential HVAC for Hot-Dry Climates	HVAC manufacturers design and package refrigeration components to meet average outdoor and indoor conditions. This results in equipment with sensible heat ratios (SHR) of about 0.75 to 0.80, resulting in latent cooling fractions ranging from 0.20 to 0.25. In hot-dry climates latent cooling does not contribute to improved comfort. Ideal hot-dry climate vapor compression equipment would have SHRs above 0.90 or 0.95 to both improve comfort and maximumize efficiency
Electric	R	HVAC	Residential Night Ventilation Cooling Field Monitoring Project	This project analyzes and tests the integration of night ventilation cooling technology into a standard heating, ventilation, and air conditioning (HVAC) system. Night ventilation systems automatically ventilate houses using the normal air handler, supply, and return duct system, as well as a smart thermostat, mechanical damper, inlet and exhaust ducts. The smart thermostat monitors indoor and outdoor temperatures. When the outdoor temperature is lower than indoor, the system turns the air conditioning system off and ventilates the house with 100% outside air. Ventilation occurs throughout the night, exhausting the building mass and preparing the house for the next day.

Electric	C	Lighting	Low Wattage Ceramic Metal Halide Lamp	Advances in metal halide (MH) lamp technology have led to the production of ceramic metal halide (CMH) lamps that use ceramic rather than quartz arc tubes typical of most MH lamps. Ceramic arc tubes can tolerate a higher temperature than quartz, resulting in improved color rendering and color temperature and the warm tones desired in retail and other color-sensitive applications. CMH lamps they have a much longer life and use just half of the energy.
Electric	C	Lighting	Smart Stairwell/Hallway Lighting	Stairwell light fixtures in commercial buildings normally operate 24/7, using large amounts of energy to illuminate mostly unoccupied stairs, alcoves and landings. Utilities are evaluating new fixtures incorporating occupancy sensors that bring dimmed safety lighting up to full levels only when someone enters the stairwell.
Electric	R	Other	In-Home Energy Use Displays	In-home energy use displays provide real-time feedback to occupants on whole-house electricity consumption. These devices involve three basic components: a sensor that collects energy use data from the meter or circuit panel, a wall or desk-mounted display, and a means of communication between the two. The devices can display both instantaneous power usage and cumulative energy usage over selected time periods.
Electric	C	Other	New Methods for Retrocommissioning and Continuous Commissioning	Retrocommissioning involves a systematic step-by-step process of identifying and correcting problems and ensuring system functionality. Retrocommissioning focuses on steps for optimizing the building through O&M tune-up activities and diagnostic testing. Included in this item is Bulls-Eye Commissioning.
Electric	C	Electronics: Data Centers	Improved Data Center Design	Improved data center design can consist of improved air flow design, centralized air handling systems, and variable CRAC compressors. Methods of improving airflow include hot aisle/cold aisle design, flexible barriers, ventilated racks, and optimized supply/return configuration. Centralized air systems use larger motors and fans, and can be more efficient than traditional designs. They are also well suited for variable volume operation through the use of Variable Speed Drives. Additionally use of direct liquid cooling and effecienct uninterruptible power supplies can improve effeciency.
Electric	C	Electronics: Data Centers	Server virtualization	Server virtualization enables network administrators to consolidate computing resources across their network. Virtualization could increase the utilization rate of servers and thus reduce the number of server computers required reducing energy.
Electric	I	Crosscutting	Distributed Wireless Multisensor Technologies to Reduce Motor Energy Usage	Motors consume an estimated 63% of all electricity used in industry. In an effort to reduce plant power consumption, sensors are often used to monitor the efficiency of motors used in industrial applications. The wireless technology has been demonstrated under controlled industrial conditions and further field testing is underway (2004).

Electric	C	Refrigeration	Fiber Optic Refrigerated Case Lighting	Fluorescent lights are typically mounted inside the door frame of reach-in refrigerated cases. They provide ample lighting on the products but must be overdriven to operate properly in the cold temperatures. All heat produced by the lamp is emitted into the cold space. Fiber optic lighting uses a remote light source sitting outside of the case and delivers it to the product using large core optical fiber. This technology reduces the lighting power requirements by distributing from a single source to multiple doors and by keeping heat generated by the light source outside of the refrigerated space.
Electric	R/C	Lighting	LED Downlighting	Interior lighting that is provided by LED sources. LED bulbs and tubes are made to fit current sockets and fixtures reducing costs of retrofits.
Electric/gas	C	Other	Laundry Wastewater Recycling	Typical operations consume 3 gallons of water per pound of laundry. Water is consumed in wash and rinse stages (~8 stages per cycle). Water temperatures range from 100-170ºF. Historically, water is discharged from each stage and replaced with fresh makeup water. However, new technology allows water to be cleaned and recycled, reducing water use and energy use.
Electric/gas	R/C	Clothes Washing	Enzymatic Laundry Detergent	In order to effectively remove fabric stains and dirt during cold (60°F) water washing, a proprietary combination of enzymes to catalytically remove stains, including amylase for starch and protease for protein, and surfactants for emulsifying and suspending soil particles are used.
gas	C/I	(I) Crosscutting: Other	Steam Trap Monitoring	Attaching advanced automated monitors to steam traps allows for the quick diagnosis and correction of steam trap malfunction. This measure can lead to energy savings beyond the energy savings achieved through regular steam trap maintenance.
gas	I	(I) Stone, Clay, Glass: General	Warm mix Asphalt	Warm mix asphalt pavements can be produced at temperatures as much as 100°F lower than traditional methods, with an associated fuel consumption savings. There are at least four competing processes in various states of development that enable asphalt to be worked at lower temperatures.
gas	C	(C) Cooking	Eneron “TurboPot”	Enhanced heat transfer design on the bottom of commercial stock pots and pans allows greater transfer of heat to the pot/pan and food. Reduces heat loss and decreases cooking time.

Table 6 provides a list of ETs reviewed in the 2008 potential study

Table 6. Emerging Technologies Reviewed in the 2008 Potential Study

Residential Emerging Technologies
Night Economizer, Current Emerging Technology
Cool Roof, Current Emerging Technology
LED Reflector, Current Emerging Tech
LED Christmas Lights, Current Emerging Tech
Commercial Emerging Technologies
Gas Space Heating Boilers 95% - current emerging tech